Implementation of A-SMGCS Routing and Airport Safety Support Service on Fraport Apron

SESAR Deployment Manager
Brussels, 25 April 2019

Andreas Eichinger (Fraport)
Ieyasu Sugimoto (ADB SAFEGATE)
Project Objectives
Tender Specification

Frankfurt/Main was the first airport to specify and publish a tender for an A-SMGCS fulfilling the routing and planning functionality according to Implementing Regulation (IR) 716/2014

- Requirements as written in IR 716/2014 are very vague
- Operating contexts at airports differ considerably; Frankfurt/Main is an airport with “grown infrastructure”
- General implementation guideline for industry was not available in 2016
Project Objectives

- Compliance with IR 716/2014
- Highly integrated working environment for apron controllers with high usability on a single screen solution
- Reduced workload for controllers
- Reduced frequency usage
- Enhanced situational awareness for controllers (plus pilots and vehicles drivers)
- Operations ideally independent of weather operations
- “Optimal” routing
- Detection of (potential) conflicts
- Foundation for automated guidance
Product Goals

- **Intuitivity** – simple and intuitive user interaction
- **Configurability** – highly configurable with parameters
- **Modularity** – system is based on different services based on modules
- **Interoperability** – interfaces are future proof, less use of proprietary interfaces
- **Automation** – high, but configurable level of automation; controller as supervisor
- **Focus** – only relevant information is displayed, additional information can be easily retrieved
- **Expandability** – services and other components have to be expandable
- **Flexibility in role concept** – system has to support current and future controller roles and responsibilities
How did we proceed?

2016-2017  Bid process, evaluation phase (five days per bidder)
2017      Tender award
2017 onwards  Realisation (industrialisation) in two phases

Phase 1: Focus on IR 716/2014 compliance
Mid 2019:  Start apron simulator integration
End of 2019:  Start training
End of 2020:  Go-live

Phase 2: Enhancements beyond IR 716/2014 (e.g. guidance functionality)
Lessons learned so far...

- Even though SESAR validation for routing and planning functionalities was successfully executed, none of the products tested during the evaluation phase was mature enough to be deployable out of the box at Frankfurt/Main. All products required further development (industrialisation).

- SESAR focuses rather on technical solutions rather than operational challenges and user interfaces or user experience.

- Basic routing and planning functionality was available, but support for operations at airports with complex infrastructure/layouts and high-density operations was not mature.
Software Development How We All Know It...

- How the client explained it
- How the project manager understood it
- How the analyst designed it
- How the programmer coded it
- How the business consultant described it
- How the project was documented
- What operations installed
- What the client paid
- How it was supported
- What the client actually needed
Iterative Development Using Scrum
Scrum Methodology
Change Management

The implementation of the jointly developed Apron Controller Working Position (ACWP) at Frankfurt/Main will significantly change the working environment and the actual work of apron controllers. Proper change management is paramount to ensure a smooth transition! What does this mean in practice?

• Apron controllers are involved in development and implementation processes
• We have two demo systems showing the current state of the system at two apron control towers.
• Apron controllers are part of the project team reviewing sprint results and planning upcoming sprints.
• ...
ADB SAFEGATE / Fraport
Product Functionality for Routing and Planning and Surface Safety Nets
Surveillance Service

Routing and Safety Support Service demand a higher surveillance performance, also in areas that are close to terminal buildings

- Otherwise nuisance alerts irritate controllers
  - Route deviation alerts caused by wrong detection
  - Wrong safety net alerts (e.g. Push without Clearance)

- More interaction with the target label => needs to be steady
Electronic Clearance Input

Fundamental for support of Safety Support Service and Routing Service

Tight Integration with Routing Service
- Routing Service calculates the handover points
- Workflow Service calculates clearance input based on handover points

Either input via target label or via electronic flight strips
Electronic Clearance Input

Example Workflow – Routing Integration
Electronic Clearance Input

- DLV (DFS)
  - ATC Clearance
  - Start-up Clearance
  - Transfer MCW

- MCW
  - Push back Clearance
  - Taxi Clearance
  - Transfer MCC

- MCC
  - Continue Taxi
  - Transfer MCE

- MCE
  - Continue Taxi
  - Transfer TWR/DFS

- DFS
  - Line-up Clearance
  - Take-off Clearance
  - Airborne
  - Transfer to Radar

Co-financed by the European Union
Connecting Europe Facility
Electronic Clearance Input

- DLV (DFS)
  - CLR
  - SUCL
  - MCW 122,2

- APRON CWP 1
  - PUSH
  - TAXI
  - MCC 123,1

- APRON CWP 2
  - CONT
  - MCE 121,3

- APRON CWP 3
  - CONT
  - TWR 123,5

- TWR (DFS)
  - LUP
  - TOCL
  - RDR 122,7

Co-financed by the European Union
Connecting Europe Facility
Clearance in label instead of flight plan supports stripless working

Synchronized with electronic flight strip supports both ways
Route Proposal and Modification

- Aircraft (CCA935) is assigned a route based on configuration parameter
  - **Standard route patterns** depending on
    - Position and Destination,
    - Runway Configuration,
    - Visibility,
    - Aircraft Class and Type.
    - Taxiway availability (closures)

- Controller can change the route proposal
- Route is cleared (grey => green)
Area of responsibility

- Route proposal (BAW909U) automatically includes handover point (red dot)
- Clearance automatically only up to handover point
- Route modifications only in own AoR
Handover of Responsibility

- When aircraft reaches handover point, controller transfers.
- Next controller will clear clear next segment with “CONTINUE”
- Route indication shows clearance
Routing Clearance Limit

- Controller can add clearance limit
- Different representation (solid => dashed)
- Continue action to clear rest of route
Pushback as Part of Routing Service

- Default standard PB Procedure depends on position, aircraft type or wing span category, runway configuration, visibility (Area 2, taxi via N7)

- Other standard PB procedures can be displayed and selected

- Proposed route will change accordingly (Area 7, taxi via N8)
Free Pushback as Part of Routing Service

- Free Pushback can be entered

- Change from Area 7 to non-standard point on N8, nose facing west

- Route is adapted accordingly
Tow Routing as Part of Routing Service

- Same routing functionality as for aircraft also applies for tows
- PB procedure can be selected
- Different standard route configuration compared to aircraft
- Note: Vehicles not part of routing service
Stand Status as part of Planning Service

Indicate the status of the stand visualized on the a Airport map

- Show state of positions (free, occupied, etc.)
- Show next flights/tows at gate
- Safety logic to avoid A/C conflicts
- Display A-CDM Information

Co-financed by the European Union
Connecting Europe Facility
Airport Safety Support Service - CMAC

Taxi without Clearance
• Movement detected
• No ECI
Conflicting ATC Clearance

- ECI Input
- Conflict detected

Case shown

- Controller gives Take-Off Clearance
- ASSS detects that a vehicle is on the runway
- Warning is displayed

Note: not part of delivery in Fraport project
Usability and User Acceptance

A- SMGCS used to be a support screen
• User interaction with the system used to be limited
• Users log on to screen, set their window preferences, and will interact rarely

A- SMCGS becomes an operational tool
• Much more interaction on A- SMGCS (Electronic Clearance Input, Route modifications)

Integrated Controller Working Position in general
• More information is shown on screen => abstraction needed to avoid overflow
• More user interaction with elements shown on screen => more focus on UI/UX
Interim Results/1

- As software development is based on SCRUM we have a *pretty good idea on the state of the system* and, thus, the project. In addition to this, we have regular releases (“potentially shipable increments”) on two demo systems in our apron control towers to allow for continuous and fast feedback.
- The *inauguration of the new system* was initially planned for 30 June 2019. We will incur significant delay.
- Clearly a *huge gap between validation and industrialisation of technology exists*. 
Interim Results/2

• Frankfurt/Main employed a **multi-stage supplier selection process following EU rules**. As we wanted to be sure to select the best supplier we included 5 day test installations in Frankfurt/Main in the selection process and weighed functional capabilities and price roughly equal.

• The **design of the supplier selection process** made sure that the most suitable supplier for our operating context was selected.